EDELSTEIN

WITNESS: EDELSTEIN
D.T.E. 03-40
EXHIBIT KEDNE/RBE-1

DIRECT TESTIMONY OF RONALD B. EDELSTEIN

GAS TECHNOLOGY INSTITUTE

ON BEHALF OF

BOSTON GAS COMPANY

D/B/A KEYSPAN ENERGY DELIVERY NEW ENGLAND

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Q. Please state your name and business address.

A. My name is Ronald Edelstein. My business address is 1700 South Mount Prospect Road, Des Plaines, IL 60018.

Q. By whom and in what capacity are you employed?

A. I am employed by the Gas Technology Institute ("GTI") as Director, State Regulatory Programs.

Q. Please describe your educational background and professional experience.

A. I graduated from the University of Florida with a BS in Aerospace Engineering (1969), Rensselaer Polytechnic Institute ("RPI") with an MS in Engineering Science: Solid Mechanics (1972), and another MS from RPI in Engineering Science: Environmental Science & Technology (1977). I began my employment with Pratt & Whitney, working as a structural engineer on gas turbines for 8 years. I was then employed by Planning Research Company as an engineering consultant to the U.S. Department of Energy doing research and development ("R&D") on solar thermal technologies for three years, then the Solar Energy Research Institute as an R&D planner for three years, then the Gas Research Institute ("GRI"), now GTI, for 20 years, as an R&D planner, strategic planner, Director of Planning, Director of Sales, and currently Director of Regulatory Programs.

Q. Have you ever testified before any state regulatory commission?

A. No, but I have submitted written testimony before the Kansas Corporation Commission in the matter of the 2003 base rate case filing of Kansas Gas Service. Oral testimony in Kansas is expected later this year.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to summarize the results of gas R&D over the last two decades, to describe the cost savings, increased safety, and other benefits that Massachusetts consumers now receive from this R&D, to describe unmet gas consumer R&D needs, and to request that the Massachusetts Department of Telecommunications and Energy ("DTE") authorize Boston Gas Company d/b/a KeySpan Energy Delivery New England ("Boston Gas" or the "Company") to collect a surcharge from its customers to fund gas-consumer-benefits R&D.

Q. What is "gas-consumer-benefits research and development"?

A. This is specific R & D in which the applicable technologies result in benefits to gas consumers.

Q. What is the GTI?

A. Natural gas local distribution companies ("LDCs") and pipeline companies, in agreement with the Federal Energy Regulatory Commission ("FERC"), formed the GRI in 1977 in the midst of natural gas curtailments and a predicted gas supply shortage. That organization has performed R&D management for over 25 years on behalf of gas consumers and the gas industry that has resulted in over 400 products, processes, and techniques reaching the marketplace. In 1999, GRI merged with the Institute of Gas Technology, the nation's foremost gas R&D laboratory, to form GTI.

Q. Is GTI the only organization that manages and performs R&D for gas consumers and the gas industry?

A. No. GTI, Northeast Gas Association "formerly NGA/NYSEARCH," the Pipeline Research Committee International, the U.S. Department of Energy ("DOE"), Battelle Laboratories, Southwest Research Institute, Sandia National Laboratories, universities, manufacturers, R&D firms, and individual LDCs have managed and performed R&D on the behalf of gas consumers and the gas industry over the last two decades.

Q. What have been the benefits of these efforts to Boston Gas customers?

A. Substantial benefits have accrued to Boston Gas consumers in the form of lower-cost and more abundant natural gas supply, increased safety and reduced distribution and transmission system costs, reduced demand and lower energy costs from increased-efficiency and lower-emissions end-use equipment.

Q. Can you describe in more detail the benefits consumers realized as a result of natural gas supply R&D?

A. Yes. The most important result from natural gas supply R&D is the bringing on line of "unconventional gas" from coalbed methane, tight gas sands, and other low-permeability resources. Production of coalbed methane, called "moonbeam gas" by its detractors in the early 1980's, jumped from 100 billion cubic feet ("bcf") /year in the 1980s to over 1,000 bcf /year in the 1990s. During the same period, production of tight sands gas went from only 300 bcf /year to over 2,000 bcf /year. R&D performed by GTI, the U.S. DOE, producers, and others reduced the technical risks inherent in finding and recovering these unconventional gas resources and bringing them into mainstream production. This helped to produce the "gas bubble" of the 1980s, which resulted in major increases in natural gas production, helping to bring down the price of natural gas to customers of Boston Gas and across the country.

Q. What have been the results of R&D efforts to increase the safety and reduce the cost of gas transmission and distribution systems?

A. R&D efforts have resulted in new classes of equipment, procedures, and materials becoming available for gas distribution systems, bringing down the cost of installation and helping to reduce operations and maintenance costs.

Q. Can you give a specific example of the new classes of equipment?

A. Yes. Most gas mains and services installed in the 1970s used trenching tools, which tore up the surface and subsurface, increasing restoration costs and risked penetrating near-surface utility lines. Six years of R&D yielded the first set of guided horizontal boring tools which are now in general use throughout the gas industry, providing substantial O&M cost savings. This "trenchless" technology saves substantial dollars and has a lot less impact on the surface than the older technologies.

Q. Can you give a specific example of the new procedures that have been put in place?

A. Yes. Plastic pipe squeeze-off guidelines, procedures for minimizing static electric discharge on plastic pipe, shoring guidelines, and electrofusion joining guidelines have all provided critical information to LDCs that have enabled them to maintain and increase their already high safety record.

Q. Have there been other R&D-based advances that have improved operational safety?

A. Yes. The newly developed optical methane detector, for example, works by shining a light beam across the front of a vehicle enabling the operator to quickly and reliably scan streets for methane leakage. Many LDCs conduct required leak inspections by a walking survey; the OMD will allow LDCs to convert to driving surveys with a significant reduction in response time and reduction in labor cost.

Q. Can you describe the new materials that have been made available as a result of R&D?

A. Yes. Major advances in the understanding of polyethylene pipe, or PE, have resulted in superior medium and high-density PE materials, with substantial cost savings over steel mains that were used in the 1970s and 1980s. PE now accounts for over 90% of the new mains going into service. For in-home use, R&D has resulted in the development of corrugated stainless steel tubing, or "CSST", that can be "snaked" though the walls, reduces costs directly for the home owner and apartment renter in installing interior gas piping.

Q. What has been the primary emphasis of end-use R&D?

A. The development of increased-efficiency, lower-emissions end-use equipment has been the main target of end-use R&D for residential, commercial, and industrial customers.

Q. What results has gas-consumer-interest R&D had with its research into residential space heating?

A. Prior to the early 1980s, a typical home furnace efficiency was in the range of 60% to 70%. With the introduction of the 96%+ efficiency fully condensing pulse combustion furnace, we raised the bar and encouraged manufacturers to develop options for the fully condensing furnace. Today, condensing furnaces with over 90% efficiency account for about 25% of residential furnace sales; the pulse combustion furnace and its derivatives are still among the most efficient furnaces on the market.

Q. What about commercial applications of GTI's R&D?

A. R&D efforts have produced a new generation of engine-driven, absorption, and desiccant-based cooling systems. First-generation single-effect absorption cooling systems had coefficients of performance ("COPs") of 0.6; the efficiencies of these new systems (developed as a result of GTI and other R&D) are verified for COPs

ranging from 0.8 to 1.2, producing gas savings as well as lowering peak electric loads.

Q. What about industrial applications of gas-consumer-interest R&D?

A. Advancements in industrial combustion equipment helped increase the efficiency and lower the emissions from process heating and boiler steam production markets. For instance, in 2001, advanced oscillating combustion on a forging furnace resulted in a 49% decrease in NOx emissions and a 3% decrease in fuel usage, while keeping the average CO emissions below 100 ppm; this technology has applications to a wide range of high-temperature industrial furnaces.

Q. Would the private sector have invested in this R&D without the existence of gas-consumer-interest R&D funding?

A. That is not likely, because current laws and regulations in general require far lower efficiencies and allow higher NOx emissions. Manufacturers generally have no incentive – cost or otherwise – to produce such efficient or environmentally friendly equipment. What gas-consumer-interest R&D accomplishes is to lower the technical risk to the point at which manufacturers can then pick up the technology and carry it to the marketplace.

Q. How does R&D contribute to consumer safety?

A. Typically, as new equipment is developed, systemic gaps between sectors can cause problems in the areas of safety and reliability. For example, gas furnace corrosion is dependent on vent system design and installation but, typically, the meter and upstream service is handled by the LDC, the furnace by the manufacturer, and the vent system by the installers. As manufacturers began to offer partially condensing furnace designs with 80% to 90% efficiencies, the heat exchanger and vent system began to experience corrosion problems which did not exist in the lower-

efficiency furnaces sold before 1981. R&D enabled the design of improved heat exchangers and developed vent installation instructions that minimized the amount of condensation and hence corrosion. Today, these furnace installation instructions are included in every residential furnace sold in the U.S., and its vent design procedures have been incorporated into the National Fuel Gas Code.

Q. Do you have other examples of safety-related R&D?

A. Yes. Other safety-related research resulted in the elimination of "false positives" from CO monitors and developed scientific data for acceptable NOx levels for indoor air quality. In 1998, a consumer safety R&D project introduced a test methodology to evaluate new water heater designs that could reduce or prevent flammable vapor incidents when flammable liquids are improperly stored adjacent to the heater.

Q. What R&D issues and potential benefits remain for gas consumers and the gas industry?

A. I believe there are substantial remaining issues for gas supply, delivery, and use that have environmental benefits, safety benefits, and cost savings to customers. There are many vital reasons for continuing consumer-interest R&D funding. Some examples of needed R&D that would benefit Boston Gas customers include:

- Substantial research is needed to enhance the confidence in current nondestructive evaluation ("NDE") techniques used to inspect natural gas pipelines and higher-pressure distribution lines. A substantial portion of the national pipeline system is not "piggable"; that is, valves, bends, turns, reduced-diameter pipe sections, or other obstructions prohibit internal inspection by moving a mechanical device, or "pig", through the pipe. Further, current NDE tools and technologies can detect pipe wall thinning and circumferential flaws but other types of flaws, such as stress corrosion cracking and axial flaws, are very

difficult to detect. Only additional R&D can ameliorate these and other issues such as pipeline coatings lifetime determination and microbiologically influenced corrosion.

- Despite 20 years of research, we are still unable to reliably locate buried plastic pipe under all types of soil and moisture conditions. Tracer wire laid above the pipe is helpful but, since it can corrode or break, locating plastic pipe by tracer wire is not always reliable.
- The guided horizontal boring tools described earlier are guidable from point to point as well as steerable; however, they still cannot "see" in front of themselves underground. The ability to locate sewer pipes, utilities and other obstacles is still an important and unresolved safety issue.
- Infrastructure Security is at the forefront of national attention following the events of 9/11. R&D in this area is still uncharted; yet the "cyber" and physical security of our natural gas infrastructure is critical to gas consumers and the national interest.
- Environmental issues surrounding old manufactured gas plant sites will cost millions of dollars to clean up. Environmental research, beginning with the determination of environmentally acceptable endpoints ("how clean is clean?"), is still required to minimize environmental compliance costs.
- End-use programs that are under development but which will not be able to proceed without continued funding include a low-cost, fully condensing residential water heater which is over 92% efficient, a residential heating-only absorption-based gas heat pump with a heating COP of 1.4, and an industrial super-boiler with efficiencies over 96% currently being funded by DOE as a laboratory sub-scale pilot project.

- A low-cost residential/commercial fuel cell is still not on the horizon. The private sector and DOE are developing a host of technologies for distributed generation, including larger fuel cells, reciprocating engines, and microturbines. However, their successful integration into the gas distribution system and electric grid is still not assured, emissions and costs (compared to central station generation and electric T&D system upgrades) need to be analyzed, and their impact on the reliability of the gas and electric infrastructure has not yet been documented.

Q. How is GTI currently funded?

A. Since it was established in 1977, GTI has been funded through a FERC-authorized surcharge on gas transported over the interstate pipelines. Boston Gas customers have supported GTI R&D through upstream supplier prices, which were in turn charged under Boston Gas's retail cost of gas. The surcharge was 1.74 cents per Mcf surcharge until 1998. The surcharge has been transitioned down to 0.56 cents per Mcf in 2003. The FERC has decided to discontinue that charge at the end of 2003 and transfer the funding authority to the state jurisdiction.

Q. Why was the FERC surcharge phased out?

A. This phase out was the result of gas industry restructuring. Increased pipeline-to-pipeline competition and discounting of large customers led to gas pipeline concerns that carrying the R&D surcharge could put the pipeline at a competitive disadvantage relative to those pipelines that did not carry the surcharge. This led to the 1998 FERC Settlement Conference, that, while endorsing the benefits of consumer-interest R&D, phased out the FERC-approved funding mechanism. However, the FERC gave GTI and the gas industry seven years to phase in a state-by-state surcharge and encourage state commissions to proceed on that basis.

Q. Would you summarize your testimony?

A. Consumer-interest R&D benefits all customers. Over the past twenty-five years, gas consumers have realized billions of dollars of benefits from gas consumer interest R&D. Our overall consumer benefit-to-cost ratio is 9/1, including all R&D costs and benefits from commercialized products and services. Based on our over twenty-year track record of maintaining benefit-cost ratios of over 9/1, I believe that in the future Boston Gas can sustain this benefit-cost ratio for Boston Gas's customers.

These R&D programs are very important for Boston Gas's customers, and I support the Company's proposal even if the Company should choose not to use the services of GTI.

Continuation of the gas-consumer-interest R&D program is absolutely critical for the continued distribution and use of natural gas as a current and future environmentally benign, domestically produced energy source for Massachusetts and for the United States.

Q. Does this conclude your testimony?

A. Yes.